VIEWPOINT

INSIGHTS FROM THE FRONT LINES

Preventing the Next Pandemic

Governments, academia, civil society, philanthropists, and the private sector must jointly take five priority actions to stop the global spread of disease.

BY MARK SMOLINSKI

The discovery of a novel coronavirus in Wuhan, China, should not surprise anyone. Coronaviruses are well-known microbial threats, and SARS-CoV-2, the cause of the ongoing COVID-19 pandemic, will not be the last coronavirus to threaten the globe. The world will continue to struggle with COVID-19 for some time, yet it must do so with the knowledge that other yet-to-be-named viruses will emerge from planetary hot spots in the future.

Nevertheless, ending pandemics is an achievable goal. Realizing this vision requires all countries to detect the earliest signs of a potential outbreak fast enough to take local action and prevent global spread. Every microbial threat is different, but in all cases, speed of detection is critical for a timely response.

Over the past decade, a series of early-detection efforts across the globe have illuminated the necessary paths forward. The most successful of these initiatives rely on social innovation of both local ingenuity and cross-sector collaboration. Specifically, securing a pandemic-free future requires governments, academia, civil society, philanthropists, and the private sector to take five priority actions. When fully adopted, these measures will transform pandemic preparedness in the future.

1. ***Engage directly with the public:*** *Countries that engage their populations in the direct reporting of symptoms of illness detect dangers earlier and respond to health crises faster.*

The first evidence of disease emergence typically appears in a cluster of people with similar symptoms from a given locality. Detection of a potential outbreak usually requires several people engaging with the health-care system, but it can still go unrecognized if the individual cases are not connected. With direct community reporting, officials can spot patterns of illness even before affected people seek medical care.

The development of participatory surveillance—new systems for enabling the public to directly report symptoms—has shown tremendous results in providing timely snapshots of potential disease clusters. Many systems permit only the user to report, but some allow community health workers, caregivers, and family members to report on behalf of others, including children and the elderly.

In 2011, Ending Pandemics, the nonprofit I lead, joined forces with Harvard University's HealthMap to launch Flu Near You as a free, voluntary system for the public to self-report symptoms of influenza in the United States. The reported symptoms are mapped in real time on a public website, along with information on influenza vaccinations and other health resources. The US Centers for Disease Control and Prevention (CDC) relies on Flu Near You as its only population-based system for monitoring influenza-like illness outside of the health-care system. In 2020, Flu Near You expanded to become Outbreaks Near Me to also monitor for COVID-19 and other emerging infections among the general public. Participatory surveillance has been successfully deployed for short-term user engagement at mass gatherings in Brazil, first at the World Cup in 2014 and again at the 2016 Olympic and Paralympic Games.

Participatory surveillance can take many forms. In 2016, Cambodia launched a free national hotline for the public to report any health threat directly to national authorities. The system fields on average 600 calls daily, and every month 20 to 30 of the calls typically require immediate action by health authorities. When COVID-19 emerged, Cambodia's hotline began receiving up to 18,000 calls per day, identified approximately 90 percent of the country's early COVID-19 cases, and provided critical information for a rapid response. Other countries also developed COVID-19-specific self-reporting systems during the pandemic that further validated the utility of participatory surveillance.

2. ***Deploy a One Health approach:*** *Communities that espouse the interdependence of humans, animals, and the environment are more successful at predicting and preventing outbreaks.*

Interactions of humans with animals and diverse ecosystems continue to trigger spillover and disease emergence, as Ebola, hantavirus, HIV, SARS, and Zika have demonstrated in recent decades. Three out of every four emerging infections arise in animals before spreading to humans. Climate change, land use, and the distribution of

ILLUSTRATION BY NATHALIE LEES

MARK SMOLINSKI is a medical epidemiologist and president of Ending Pandemics, a US nonprofit working to detect, verify, and contain outbreaks faster across the globe. His work focuses on supporting innovations in disease surveillance, training the next generation of epidemiologists, and supporting regional disease surveillance networks.

rodents, mosquitoes, and other transmission vectors all contribute to increased disease risk. A One Health approach accounts for these interactions and can enable the prediction, prevention, and early detection of emerging infections.

Participatory surveillance systems that adopt the One Health approach are demonstrating the critical role of communities in early detection. In Thailand, village health volunteers report suspected illness in poultry and livestock through submission of photos and simple data forms on mobile phones. The country's Participatory One Health Disease Detection (PODD) system uncovered an initial case of foot-and-mouth disease in a cow that led to immediate wide-scale vaccination of all village cattle, preventing further spread and saving an estimated $4 million by preventing a ban on their milk exportation. Today PODD has been adapted to also receive reports on food safety, contaminated water, COVID-19, and counterfeit drug sales. In 2021, PODD won the grand prize in The Trinity Challenge, an initiative by a coalition of companies, foundations, and universities to support ideas for using data and analysis to address global health emergencies.

3. ***Expand epidemic intelligence:*** *Early detection and investigators at the source are key to stopping the spread of disease.*

Today, outbreaks across the globe are often first detected through automated or human-curated data mining systems that scan digital resources for early-warning signals suggestive of an outbreak. The newest such system is the Epidemic Intelligence from Open Sources initiative (EIOS), managed by the WHO. It continually scans more than 20,000 publicly available digital resources using the One Health approach. Other such systems include the Global Public Health Intelligence Network, GeoSentinel, and HealthMap.

As the number of early-warning systems increases, the need to verify initial alerts becomes critical to avoid delays in activating a timely response. Human intelligence near the geographic location of a suspected outbreak can dramatically improve the efficiency of early warning by allowing for rapid verification of an acute event. In 2014, Ending Pandemics created EpiCore to verify signals of potential outbreaks when first identified through one of the automated or human-curated early-warning systems. This crowdsourced community of more than 3,100 epidemiologists in 158 countries provides contextual information to queries sent through the platform by other organizations and can verify a potential threat within 24 hours. In the case of COVID-19, network members provided information within six hours of a request, noting that the seafood market reported as the epicenter in Wuhan also sold live species of wildlife. Within 10 days of the Wuhan alert, EpiCore members reported the first COVID-19 case in nearby Jingmen.

While human capacity is helping with the verification of early alerts, laboratory confirmation remains the gold standard for identifying the causative pathogen. In many of the planetary hot spots for emerging infections, however, laboratory capacity to identify a novel pathogen is limited or may be available only through a regional laboratory serving multiple countries. But the human capacity to verify a potential threat can enable a rapid response even in the absence of a definitive diagnosis from a laboratory.

4. ***Collaborate with neighboring countries:*** *Trust and transparency improve when neighboring countries strive for greater regional pandemic preparedness.*

Countries that share borders, resources, and flows of people and goods can capitalize on their mutual interest to quickly limit outbreaks from spreading. Both informal regional networks and more established collaborations, such as the regional offices of the WHO, the Food and Agriculture Organization, and the World Organisation for Animal Health, can provide mechanisms for neighboring countries to develop strategies and approaches that reach across national borders for greater regional resiliency.

In 2009, Connecting Organizations for Regional Disease Surveillance (CORDS) was created through a collaboration of donors, including the Skoll Global Threats Fund, the Nuclear Threat Initiative, The Rockefeller Foundation, the Bill & Melinda Gates Foundation, and Fondation Mérieux. Today, CORDS operates as a program of Ending Pandemics, serving as a network-of-networks to share best practices, scale innovations in surveillance, promote One Health, and foster new regional networks. The founding CORDS member networks encompass 28 countries across Southeast Asia, the Middle East, Southeast Europe, and Southern and East Africa. Through CORDS, the various networks come together to conduct joint operational research and update each other on pressing issues in their regions. The friendships and trust generated by such collaborations are instrumental in achieving the transparency necessary to stop an emerging health threat.

5. ***Measure progress:*** *Timeliness metrics help track progress and identify gaps in detecting and responding to outbreaks.*

While large-scale international efforts provide useful information to help measure capabilities periodically among individual countries, a succinct set of standardized metrics are needed to help countries continuously monitor their performance. In 2014, Ending Pandemics developed a set of measures, timeliness metrics, which were piloted in 27 countries and refined through two international convenings to assess feasibility and establish baselines for measurements. Timeliness metrics, including time to detect, time to verify, and time to respond, are used to benchmark and evaluate performance in pandemic preparedness. In addition to use by countries, timeliness metrics are now included in various programs of the WHO and the CDC.

Keeping Outbreaks Localized

Early detection is by far the most achievable and cost-effective way to prevent a threat anywhere in the world from becoming a threat everywhere. In my experience, no community is too hard to reach, no country is too poor to innovate, and curiosity outshines fear across the globe. By applying these five priority actions, governments and their partners can continuously monitor their ability to predict, prevent, detect, and respond to outbreaks while they are small, localized events—securing a future for the planet that is free of pandemics. ■